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ABSTRACT

This examination of microcomputer use in primary schools begins by comparing the national data for elementary schools for 1984-1985 with the findings of a study of seven elementary schools in the Anchorage (Alaska) School District (ASD) which was conducted in the same year. Current research findings are cited in a discussion of assumptions about the instructional effectiveness of computers, and it is noted that the overall results of the ASD study failed to show that the computers have been either effective or ineffective in improving academic achievement. A description of the process used by ASD to integrate computers into the primary school classroom highlights coordination, including the development of a scope and sequence guide together with long range goals and objectives to ensure uniformity within the curriculum; provisions for inservice teacher training; provisions for maintenance and repair of the microcomputers; the acquisition of hardware and software; and a systematic approach to instruction. A brief description of teacher use of computers includes the names of software used for various purposes, and a discussion of trends in educational software focuses on applications programs for students and the use of CD-ROM for a district-wide union catalog of school library holdings. It is concluded that, although computers in the classroom are still in the experimental stage, they can be successfully implemented at the elementary level if adequate leadership, funding, and inservice training are provided. (BBM)

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**COMPUTER USE IN PRIMARY SCHOOL EDUCATION
AND THE TREND OF EDUCATIONAL SOFTWARE:
AN ALASKAN PERSPECTIVE**

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COMPUTER USE IN PRIMARY SCHOOL EDUCATION
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Alaska, "The Land of the Midnight Sun," America's last frontier, is the largest state in the United States and also the least populated. Anchorage, the largest city in Alaska, has a total population of slightly over 250,000 people within the 1955 square miles of the Borough of Anchorage. Anchorage, as part of Alaska, is part of the Pacific Rim and looks to Japan as both a neighbor and a trading partner. Anchorage is seven hours by air from Tokyo, five hours by air from Hawaii and almost three hours by air from Seattle, Washington, the closest major U.S. city in the contiguous continental United States.

Anchorage, however, is not isolated from either the rest of the United States or from the world. While separated geographically from the main population centers of the United States, Anchorage is not separated by means of communication. In this, the Information Age, satellites bring us telecommunications from around the country and around the world. From my office, I can and do communicate by phone

-page 1-

with any school district or company in the world. From the microcomputer on my desk, I have communicated with NOVA University in Fort Lauderdale, Florida about offering adults in Alaska the opportunity of earning advanced college degrees through courses offered via computer and available to students in their own homes. By accessing Ed-Line, an electronic education database housed in Washington, D.C., I can on a daily basis, bring to the superintendent, his cabinet and the school board up-to-date information on the major activities in education from throughout the United States, information which may effect the daily operation or policies of the district or which may have an impact upon our curriculum. Through Tech-Central, another electronic database, I can communicate with the leadership of the Association of Educational Communications and Technology (AECT); and, through DIALOG, a service also available in Japan, I can conduct information searches, usually through the Educational Resources Information Center (ERIC), on topics of educational importance to the administration and faculty. Finally, from my office and from some of our schools, we can audio conference with other districts in the state, and until recently when declining oil revenues caused the state of Alaska to eliminate the LearnAlaska satellite television network, we were able on occasion to participate in one-way video and two-way audio conferences within the state as well as receive instructional television programming which was broadcast throughout the state. Anchorage is very much a part of the global village, united through communication and computer technology.

The Anchorage School District, which encompasses the Borough of Anchorage has approximately 42,000 students in 54 primary schools and 14

-page 2-

secondary schools. There are approximately 2400 Apple // and Apple //e computers and 78 IBM computers in the classrooms of our schools. Of this number, approximately 1,500 Apple // and Apple // e's are in our elementary schools. The 78 IBM computers are used to teach word processing in our secondary schools. As the 1986 - 1987 school year began, there was one computer in each of our elementary classrooms, with the exception of Birchwood Elementary School, which chose instead to place the computers in a computer laboratory.

During the 1984 - 1985 school year, the last year for which complete data is available on a national level, eighty-five percent of the elementary schools, kindergarten through sixth grade, were using computers for instruction in the United States. The median number of computers per elementary school was six and the median ratio of students to computers was sixty to one. In a "typical computer-using elementary school," forty percent of all computers were located in classrooms, forty percent in laboratories and thirteen percent in the school libraries. The median number of student users per classroom was twenty-seven, per laboratory one hundred and fifty, and per library fifty. The median minutes per week of computer use per student user was twenty-seven per classroom, forty-eight per laboratory and sixty per library. (Becker, 1986).

In 1984 - 1985, the last year in which a research study of computer use was conducted in the Anchorage School District, seven elementary schools were chosen for evaluation of computer usage. With the exception of Birchwood Elementary School and some classrooms in kindergarten, modified primary and special education, each classroom

of the schools in the study had a computer. The average elementary student received 35 minutes per week on the computer working in groups of two - three (Dusseldorp, 1985).

During 1984 - 1985, 56% of the mean instructional time involving computers in the "typical computer using elementary school" in the United States was used for computer assisted instruction (CAI), 9% for word-processing, 12% for programming, and 17% for discovery learning and problem-solving (Becker, 1986).

The Anchorage study was not broken down by instructional method, but rather by subject area. The computers were used to teach math 45% of the time, reading and spelling 15% of the time, language arts 9%, writing 7%, social studies 3% and science 2%. (Dusseldorp, 1985). With the exception of computer programming, which is not taught in the elementary schools, one might assume on the basis of available software that the Anchorage School District was not too significantly different from the national average in its use of computers in the primary classroom in 1984 - 1985.

On the national level, the Apple // computers accounted for between one-half and three-fifths of all computers in schools throughout the United States (Becker, 1986). In the Anchorage School District all of the computers used in the elementary classrooms were Apple's.

SOME ASSUMPTIONS ABOUT COMPUTERS

As to the effectiveness of the use of computers in the classroom to enhance instruction, a wide variety of beliefs are held by individuals. For some, it is believed to be the panacea of all our educational ills, a tool which will allow for a return to a one-on-one method of teaching which dates back to ancient Greece and is best exemplified in the works of Plato (Bork, 1981). For others, it is feared that the computer will replace the teacher, or that the student will succumb to the thinking of the computer and that creativity will be lost. As with other instructional technologies which have found their way into our schools, neither may be true. However, what is important and what is needed is sound research into the use of computers in the classroom. To date, the following conclusions based on a meta-analysis of the research by Robyler (1985) appear to be true:

- * Computer-based instruction achieves consistently high effects than other instructional treatments to which it is compared in experimental situations, but the effects usually range from small to moderate in magnitude.
- * Supplemental computer-based instruction seems to result in greater effects than replacement CAI.
- * Computer-based treatments (Instruction) seem to result in significant reduction in instructional time and in more favorable attitudes toward computers.
- * Computer materials can significantly improve the capability of teachers to deliver effective instruction. (This may give support to the alternate hypothesis that the computer enhances - rather than replaces - the teacher's abilities, and that an increase in class size would decrease teacher effectiveness and therefore achievement.)

- * Most reviews report significantly better results with lower ability learners and lower (elementary) grade level students, and in mathematics as opposed to reading/language arts areas. However, this finding bears re-examination as newer, more effective computer-based reading materials are developed, and strategies for integrating them into teacher-lead activities are created.

In the Anchorage study, it appeared that computers might have been effective for teaching spelling since the students at Willow Crest Elementary School, which concentrated the use of computers on spelling instruction, gained more in spelling than would normally be expected and gained more than any of the comparison schools. Overall, the results of the study do not show that the computers have been either effective or ineffective in improving academic achievement (Dusseldorp, 1985).

Roblyer (1985), best summarizes the prevailing attitude of the impact of computers in education when he states:

Although many educators would acknowledge that data are lacking on the effectiveness of computer-based applications in specific content areas and with specific student populations, it has not slowed the purchase of microcomputers, or the development and use of computer based materials, nor do we in the front lines of instructional computing seem to rely heavily on existing research data to guide our decisions on the selection and use of materials. Ours is a movement driven primarily by assumptions about the impact and potential impact of computers upon learners and by the marketing claims of courseware publishers.

Thus, computers in education, are still in the experimental stage with much research needed to be done on their use, with much courseware needed to be written and evaluated, with more powerful and less

expensive computers needed to be developed and with greater access needed by students. Nevertheless, computers can be successfully incorporated into the classroom.

INCORPORATING COMPUTERS INTO THE CLASSROOM

Effective integration of computers in the primary school classroom requires coordination, funding, and a systematic approach to their use in instruction.

Coordination

District and/or building level coordination of the use of computers in the primary classroom is essential in order to establish uniformity within the curriculum, to establish long range goals and objectives, to provide teacher inservice training, and to maintain and repair the computer equipment.

For microcomputers to positively impact education, educational leaders must recognize that the implementation of computer education programs cannot be left to well-meaning but already overburdened classroom teachers. A specialist who can provide leadership and guidance is needed (Jacobs, 1985).

Within the Anchorage School District, a curriculum specialist was designated during the 1983 - 1984 school year to oversee the microcomputer program. Prior to that time several plans for the use of computers had been developed, but never implemented. In December of 1979, a district committee composed of interested teachers developed an "Education Plan for use of Computer Technology in ASD

-page 7-

Instructional Program, K-12." In January of 1980, the Management Information Systems Division developed "Computers in the Classroom - A Plan for the Instructional Use of Computers, January 1980 - June 1982."

While the plans were never implemented because they were too idealistic, they paved the way for future developments and by July 1980 three 1-credit courses for teachers on microcomputers were offered with a total enrollment of 66. By contrast, during the 80-1981 school year 4 different courses with a total of 26 sections were offered with a combined enrollment of 430 teachers.

Uniformity

To provide uniformity within the curriculum, the Anchorage School District developed a curriculum guide known as a Scope and Sequence for the computer program. The Scope and Sequence was put together during the 1983 - 84 school year by a committee of interested teachers and administrators headed by the computer specialist. The curriculum was based on what teachers felt could and should be taught. The limited number of existing curriculums were examined, but the curriculum which was formulated was derived on the needs of the district. The curriculum has since been used by other districts and was revised in 1985.

The Scope and Sequence begins with a program statement which reads in part that " the Computer Instructional Program of the Anchorage School District will provide the opportunity for all students to learn to use

-page 8-

computers and to develop positive attitudes, values, and motivation toward computers and their applications as appropriate for each individual's age, needs, and desires" (Computer Education Scope and Sequence 1985).

It is followed by a program philosophy which states:

1. Computer skills should be integrated throughout the curriculum.
2. Computers should be used by students for both guided and independent practice.
3. Computers should be used by students to reinforce and extend the skills and concepts taught in the classroom.
4. Computers should be used by teachers to teach and/or demonstrate selected skills and concepts, to assist with record keeping and the generation of classroom materials, and to assist with the diagnosis and evaluation of student learning.
5. Computers should be used to teach problem solving skills with other computer related skills such as word processing, data processing, information retrieval, business and personal finance, and programming.
6. The Computer Instructional Program needs to be viewed as as flexible program due to rapidly changing technology. (Computer Curriculum Scope and Sequence, 1985).

Long Range Goals and Objectives

The long range goals for the computer program are stated in the forward to each grade level's curriculum within the Scope and Sequence (Computer Curriculum Scope and Sequence, 1985).

They are the same for each grade level. The student is:

1. Able to understand and use the vocabulary,

definitions, and procedures associated with computers, their operation, and the operation of their peripherals as appropriate to needs and interests.

2. Able to associate computers with appropriate areas of application, effectively select and utilize application software, and apply this knowledge in solving problems.
3. Able to understand the nature and purpose of computer languages and programming, to develop and write computer programs as appropriate to needs and interest, and to apply this knowledge in solving problems.
4. Familiar with the development of computing devices; is aware of the impact of technology on society; is aware of career, vocational, home, and recreational uses of computers; displays positive attitudes towards computers; and understands the emerging roles of computers and their effective use in a changing society.

The goals of the computer program are followed by the basic skills for the grade level, skills which are expanded upon for each successive grade. For example, the basic skills identified for third graders are:

1. uses computer terms such as computer, monitor, keyboard, disk drive, printer, memory, cursor, boot menu, disk, program, input, output.
2. Identifies functions of disk drive, monitor, printer, and disks.
3. Turns computer on and off; boots and reboots disk by using [Control] [Open Apple] [Reset].
4. Does minor troubleshooting (reseats and reboots disk if disk doesn't boot, checks to be sure everything is plugged in).
5. Runs programs from a menu.
6. Uses a printer; uses other peripheral devices such as graphics tablet, robotic device, or programmable toy if they are available.
7. Uses problem solving/creative thinking (computer) programs such as Delta Drawing, Print Shop, Creature Creator, or Moptown

Hotel.

8. Uses a word processing program; uses a data base program.
9. Describes advantages and disadvantages of using computers; describes legal and ethical uses of computers. (Computer Curriculum Scope and Sequence, 1985)

Following the basic skills is a listing of the objectives for the grade correlating the objective with the program goal, identifying the suggested curriculum area/unit; suggested software; other resources, and whether or not the objective at this level is being introduced, expanded, reinforced, or is optional.

Returning to the example of the third grade curriculum, the objective for the first goal is to identify the functions of the disk drive, the monitor, and the printer. It is noted that this objective is being introduced at this level, and that the appropriate curriculum area/unit for introducing this objective would be either language arts, math, science, or social studies. The suggested software is Printshop, identified along with its manufacturers, Broderbund; and, Computer Terms from TIES. Under other resources, the TIES Computer Literacy Kit Step 2 is suggested. In total, there are 36 objectives listed for the third grade with 13 of them being introduced for the first time, 9 of them being expanded and 14 of them being reinforced. None of the objectives are listed as being optional.

As a point of information, a course entitled Computer Fundamentals which includes an overview of computer fundamentals, use of peripherals, and an introduction to computer applications is currently

offered in grades 9 through 12 for the "new to computer" student. Information Processing, a course which includes word processing, data processing, spreadsheets, methods of storage and retrieval, and other computer applications is also offered in grades 9 through 12 with a prerequisite of Computer Fundamentals or its equivalent or consent of instructor. Programming in Basic, courses I and II, are offered to 9 through 12 grade students with the same prerequisites as Information Processing. Programming in Pascal I and II are open to 10 through 12 grade students.

Inservice Training

In the 1983 - 1984 school year, a Microcomputer Resource Teacher position was also implemented. The number was expanded to three during the 1984 - 1985 school year and reduced to two during 1985 - 1986 because of budget cuts. The Microcomputer teachers are responsible for working with the elementary schools. They provide inservice training for teachers, software demonstrations, demonstration classes, and help with hardware or software problems. They maintain a preview library with about 500 commercial programs which are available for loan for a two week period to aide teachers in making purchasing decisions rather than relying on catalog descriptions alone. They are also responsible for duplicating and sending to schools approximately 50 disks each year, including licensed and public domain disks which can be copied for individual teachers for instructional purposes.

The criteria for being selected as a computer teacher was one's expertise with and skill with computers, a philosophy concerning the use of computers consistent with the district philosophy, and

-page 12-

self-motivation and self direction to keep current with the latest developments in the field. No programming knowledge was required.

Maintenance and Repair

To provide maintenance and repair of the District's approximately 2400 Apple Computers, all repairs are handled through the District's Audio-Visual Center. The Audio-Visual Center is an authorized Apple Computer repair facility staffed with 4 trained repairman who also service the district's audio-visual equipment.

During the 1985 - 1986 school year, approximately 1200 computers were repaired. The major problems were broken keys and nonfunctioning disk drives. Turnaround time for repairing a computer averaged one week if the computer was sent through the normal school delivery system. If a teacher brought the computer into the repair facility after school, the average repair time was 15 minutes.

Funding

To successfully meet the goals and objectives of the computer program, adequate hardware and software is needed. In 1984, the school board decided to provide funding for 1 Apple Computer for each of most of the elementary classrooms. Apple //e computers were selected because of the software that was available for them, their expandability, their graphics and sound capabilities and their relative ease of repair. In the latter instance, the usual procedure is to swap the defective component with a new one.

In addition, during the 1983 - 1984 school year, the Anchorage School

-page 13-

District became the second public educational institution outside of Minnesota to establish a licensing agreement with the Minnesota Educational Computing Corporation, MECC. The agreement allows the Anchorage School District to receive non-exclusive license to reproduce courseware diskettes using the MECC Copy System, and the courseware manuals for exclusive use in its schools. Title to any reproductions of the courseware remains with MECC. Reproductions of the courseware diskettes may be made in whole or in part only by the copy system. All reproduced courseware must include all copyright notices and proprietary legends contained in the originals. The agreement remains in effect for one year. Through MECC, the Anchorage School District has access to over 200 programs and program guides. The cost to the District, excluding diskettes for duplication and paper and printing of the manuals, for the 1986 - 1987 school year is \$5616 (MECC Institutional Membership Agreement, 1986).

The computer programs are duplicated through the District's Audio-Visual Center, cataloged by title through the District's Library Resources Department, and distributed through the computer resource teachers. The manuals which accompany the disks are reprinted in the District's Print Shop.

Systematic Approach

Just a coordination, training and funding are essential to incorporating computers into the primary classroom, so to is a systematic approach to instruction. A systematic approach to instruction in one in which there are clearly stated objectives, and a selection of media based on the potential for implementing those

objectives (Gerlach, Ely 1980). Thus, selecting the medium to be used for instruction becomes a function of the objective to be accomplished, rather than on an individual instructor or student's preference for one medium over another.

TEACHER USE OF COMPUTERS

Teacher use of computers is another facet of incorporating computers into the primary classroom. While using the computer for demonstration purposes has not been widely spread in the Anchorage School District due to the limitation of the hardware, primarily because the small monitor is difficult to view by large groups of students, it is used by teachers to:

1. Prepare classroom materials and letters to parents;
2. Keep student or inventory information;
3. Record grades or financial information (book sale or lunch money, etc.) and/or
4. Create bulletin board illustrations, etc..
(Schiffman, 1986)

The popular Appleworks program, from Apple Computer, which combines a word processing program, database and spreadsheet into one package is used by many teachers in the Anchorage School District for many of these administrative functions. The menu driven Printshop program which enables teachers and students alike to create greeting cards, flyers, posters and banners along with self-created graphics or graphics

selected from within the program or from supplementary graphics library disks is also popular.

This leads to the trend in software, which is impacted by the trend in hardware, which in turn may impact the future of education.

TRENDS IN EDUCATIONAL SOFTWARE

At the present time one trend in educational software is toward more applications programs. For example, in the MECC Educational Computing Catalog (1986), which lists all programs available from MECC, new programs available for elementary students include:

- * MECC Writer (Grades 6 - Adult) - A word processor designed especially for students.
- * MECC Speller (Grades 6 - 10) - An electronic dictionary to be used in conjunction with MECC Writer to locate spelling errors and commonly confused words.
- * Book Worm (Grades 3 - 7) - A database that helps children write book reports.
- * MECC Keyboarding Primer (Grades 4 - 9) - Introduces the various keys on the Apple //e computer and helps students learn correct fingering techniques.
- * MECC Keyboarding Master (Grades 5 - 9) - A series of drills which enables students to practice and perfect their keyboarding skill.
- * MECC Stuff and Fetch (Grades 6 - 10) - A database package which allows students to experiment as they discover personally efficient methods of data organization.

-page 16-

In the near future, interactive video will also begin to play a much larger role in the elementary classroom. The compact computer disk will allow for the storage of a large amount of information and pictures in a very small space as is witnessed in Grolier's Encyclopedia which is available in compact disk form. The compact disk, or C-D ROM as it is commonly called, is already showing some potential for use in the Anchorage School District. The district's 300,000 plus book titles are being entered into the Western Library Network electronic database. This database, although it currently contains only about half of the Anchorage School District holdings, will be available on compact disk in January. Currently, the C-D Rom player and disk technology being utilized by WLN is accessible only on the IBM Personnel Computer and not the Apple computer. Nevertheless, the entire holdings for all the 69 school libraries within the Anchorage School District, along with the holdings of all WLN member libraries in the entire Pacific Northwest United States, fit on two 5 inch compact disks. The information stored on these disks will be available within each school library containing the necessary computer hardware and software.

(Finally, according to Clements (1985),

In the future, computer instruction will most likely combine present-day CAI with knowledge gained through artificial intelligence research. The result, ICAI, or intelligent computer-assisted instruction, will be able to (a) infer students' strengths and weaknesses from their responses, (b) compare these responses with those of an expert to figure out what the student needs to learn, and (c) understand enough about teaching and

-page 17-

learning to figure out when and how it should intervene and what it should teach.

The future of computer software holds great potential in all areas provided districts have money to purchase the necessary computer equipment and its software.

CONCLUSION

While a review of the literature shows that there are many areas of research yet to be conducted in the area of computers in the classroom; while hardware still remains expensive in terms of providing adequate numbers for student use; and, while effective software remains limited, there is reason for guarded optimism in the use of computers in our elementary classrooms. By providing leadership through coordination of the computer program, by providing funding for hardware and software purchases, by providing inservice training for teachers, computers can be successfully implemented.

The current trend is toward more applications programs. In the near future interactive video, compact disk technology and telecommunications may play a larger role. And, if experts such as Clements are correct, intelligent computer assisted instruction may be a reality.

Computers in education, in the primary classroom, however, are still in the experimental stage. We, in the Anchorage School District are still discovering what works and what does not. We will keep that

-page 18-

which is effective and eliminate that which is not. However, our primary emphasis is and will remain, "to help every child achieve."

-page 19-

CHANGING PATTERNS OF INFORMATION STORAGE AND RETRIEVAL

- 1) Optical discs: video disk and CD-ROM**
- 2) Direct end-user searching of databases**
- 3) Networks**
- 4) Library automation**
- 5) Document delivery**
- 6) Electronic publication**

ISSUES AND IMPLICATIONS

- 1) High cost of new technologies**
- (2) Increased user expectations**
- 3) Changing definition of library**
- 4) Intellectual property rights**
- (5) Lack of standardization**
- 6) Training needs**